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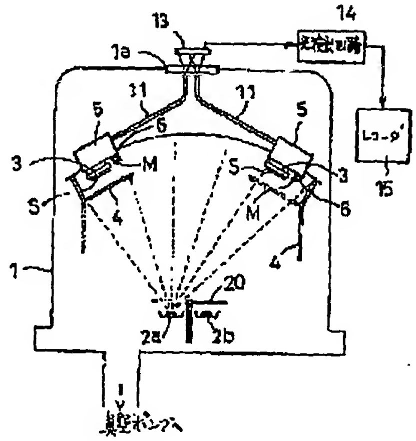
(54) VACUUM DEPOSITION DEVICE

(57)Abstract:
PURPOSE: To provide a vacuum deposition device capable of accurately controlling the optical film thickness of plural vapor-deposition samples at the same time.
CONSTITUTION: Each of the plural sample holders 3 in the chamber 1 is provided with a part 6 for mounting a monitor substrate M, a laser beam source for irradiating the substrate M with a laser beam set in a vacuum chamber, an optical system for conducting a reflected light from the substrate obtained by the irradiation with the laser beam source to a light receiving sensor 13 outside the chamber through a window 1a of the vacuum chamber 1 and a shutter 4 to stop the vapor deposition on a vapor-deposition sample on a sample holder.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention relates to the vacuum evaporation system equipped with two or more sample electrode holders in the vacuum chamber still in detail about the vacuum evaporation systems including resistance heating and electron-beam-evaporation equipment.
[0002]
[Description of the Prior Art] It considers as the method which carries out the monitor of the vacuum evaporationo thickness in the vacuum deposition including electron beam evaporation, and the crystal vibrator sensor was conventionally used abundantly. While it was accompanied by inaccuracy when optical thin films, such as a multilayer reflecting mirror and AR coat, were formed in order to measure the geometric thickness of a thin film by the dynamic technique, the thing of a vacuum evaporationo sample for which a sensor is installed very much in near was difficult in this method on the size of the sensor [itself], piping of cooling water, or the problem of a wiring of electric system.
[0003] There is an optical monitor method as a method which solves such a problem. The reflection factor or permeability to light of the single wavelength by the optical thin film is a thing using taking extremal value, when a membranous optical thickness is set to one fourth of the wavelength, and this method shows the example of a configuration of the conventional vacuum evaporation system which adopted this optical monitor method in drawing 4 .
[0004] In this example, two or more sample electrode holders 43 are formed in the rotation dome 42 in the vacuum chamber 41 which held the sources 40a and 40b of vacuum evaporationo which generate a molecular beam alternatively through a shutter 400, and the substrate for monitors 44 is arranged in a part for the center section of the rotation dome 42. While the single wavelength light from the probe light occurrence section 47 irradiates the substrate for monitors 44 through the aperture 45 and the reflective mirror 46 which were formed in the vacuum chamber 41, similarly the reflected light is introduced into the photodetection circuit 48 through the aperture 45 and the reflective mirror 46, and a reflected light intensity records on a recorder 49. And the monitor of the optical intensity by the recorder 49 is carried out, the time of the value turning into extremal value is chosen at its own discretion, and the vacuum evaporationo of the following layer is started. According to this method, there is an advantage that an optical thickness is controllable.
[0005] In addition, in drawing, S is a vacuum evaporationo sample, and 50 and 51 are the thickness monitoring devices using the crystal vibrator and its start frequency for the above mentioned crystal vibrator sensor method.
[0006]
[Problem(s) to be Solved by the Invention] by the way, in the above-mentioned conventional optical monitor method Since the probe light occurrence section 47 was in the exterior of the vacuum chamber 41, when the number of the substrates for monitors which can be arranged in the vacuum chamber 41 is limited and much vacuum evaporationo sample S is set From the reflected light by the substrate for monitors 44 or the transmitted light intensity of one piece put on the location regarded as suitable, or some, the thickness of all vacuum evaporationo sample S will be presumed. In such a method, since the space distribution of a molecular beam changed, for example in connection with the decrement of a vacuum evaporationo material even though the thickness control of each important vacuum evaporationo sample S became difficult, and two or more substrates for monitors 44 were formed and it proofread the spatial nonuniformity of those reflected lights or a transmitted light intensity to a molecular-beam intensity, when spatial nonuniformity was in a molecular-beam intensity from the source 40 of vacuum evaporationo, there was a fault that repeatability was bad.
[0007] this invention was made in view of such a point, and aims at offer of the vacuum evaporation system which can perform correctly the optical thickness control of two or more vacuum evaporationo samples simultaneously.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the vacuum evaporation system of this invention The substrate insertion section for monitors for equipping with the substrate for monitors in the vacuum chamber near [each] the electrode holder for two or more samples electrode holder of every prepared in the vacuum chamber, The laser light source which is arranged in a vacuum chamber and irradiates a laser beam at the above-mentioned substrate for monitors, The optical system which leads the reflected light from the substrate for monitors obtained by irradiation of the laser beam to the photo sensor prepared out of the concerned chamber through the aperture formed in the vacuum chamber, It characterizes by having formed the shutter for stopping the vacuum evaporationo to the vacuum evaporationo sample on a sample electrode holder.
[0009]
[Function] The light from the individual laser light source prepared in the vacuum chamber is irradiated by each substrate for monitors arranged by approaching each vacuum evaporationo sample, and the reflected light is led to it at the photo sensor of the vacuum chamber exterior. Since each substrate for monitors is put on the near corresponding to each vacuum evaporationo sample, even if a molecular beam has a space distribution, it is formed by each substrate for monitors at the

membrane formation speed of the vacuum evaporationo sample corresponding to each, and an equivalent speed. Therefore, when the reflected light intensity from each substrate for monitors by the photo sensor reaches extremal value, the desired end can be attained by closing the shutter formed for every sample electrode holder.

[0010]

[Example] Drawing 1 is a cross section showing the configuration of this invention example, and drawing 2 is an enlarged view showing the detailed configuration near each of that sample electrode holder 3.

[0011] In the vacuum chamber 1 which is open for free passage to a vacuum pump, two sources 2a and 2b of vacuum evaporationo are arranged, and the shutter 20 for opening any or one side in each of these sources 2a and 2b of vacuum evaporationo is formed. Although each sources 2a and 2b of vacuum evaporationo evaporate by carrying out a temperature up by electron beam irradiation or resistance heating, only the molecular beam of the side chosen by the shutter 20 occurs within the vacuum chamber 1.

[0012] It is vacuum evaporationo sample S linearly [opposite arrangement of two or more sample electrode holders 3..3 for equipping with vacuum evaporationo sample S in the vacuum chamber 1, respectively is carried out in the sources 2a and 2b of vacuum evaporationo, and] within the vacuum chamber 1 by which the molecular beam was maintained at the 10-7Torr base.. Incidence is carried out to S and it deposits on it.

[0013] The shutter 4..4 for interrupting a molecular beam, respectively is formed in each sample electrode holder 3..3, and these can be individually opened now and closed by operation from the exterior.

[0014] Each sample electrode holder 3..3 is supported by the pedestal 5, respectively. to each of this pedestal 5 The substrate electrode holder for monitors 6 for approaching vacuum evaporationo sample S and equipping with substrate M for monitors, respectively Pass the semiconductor laser 7 and its power circuit 8, the collimator section 9 that makes the laser beam from semiconductor laser 7 the parallel light which has a predetermined cross section, and the laser beam which passed through this collimator section 9, and it leads to substrate M for monitors. And the beam splitter 10 in which the reflected light is reflected, and the optical fiber bond part 12 which draws the reflected light from substrate M for monitors reflected by the beam splitter 10 in an optical fiber 11 are formed.

[0015] And the nose of cam of the optical fiber 11..11 with which each of this optical fiber bond part 12 was equipped is led to aperture 1a formed in the vacuum chamber 1, respectively. Each substrate M for monitors which the photo sensor 13 is arranged by the way outside aperture 1a, and was drawn by each optical fiber 11..11 .. The reflected light from M is constituted so that incidence may be carried out to this photo sensor 13.

[0016] After the conversion amplification of the output of a photo sensor 13 is carried out by the photodetection circuit 14, it is introduced into the recorder 15. The semiconductor laser 7 prepared corresponding to each sample electrode holder 3..3 is substrate M for monitors with which drives one by one to predetermined timing, and the recorder 15 was equipped every sample electrode holder 3..3.. The reflected light intensity of M is recorded one by one.

[0017] Setting in the above configuration, a molecular beam is [.. M is vacuum evaporationo sample S corresponding to each. / .. Since contiguity arrangement is carried out at S, even if some space distributions exist in the molecular beam, the difference of the membrane formation speed of vacuum evaporationo sample S which corresponds mutually, and substrate M for monitors is the grade which can be disregarded.] each vacuum evaporationo sample S. .. It is each substrate M for monitors in S. .. Although incidence is carried out also to M and it deposits on it, it is each substrate

[0018] Whenever a thickness becomes 1/4 wave so that it may illustrate to drawing 3 , the maximum and the minimum produce the relation between the reflection factor when irradiating the light vacuum evaporationo has predetermined wavelength to a certain layer, membranes being formed, and a thickness. Each substrate M for monitors .. Also to the recorder 15 which records the reflected light intensity for every M one by one, it is each of that substrate M for monitors.. The curve which changes with time according to the thickness deposited on M is drawn. Therefore, each substrate M for monitors on this recorder 15 .. It is each vacuum evaporationo sample S by closing the shutter 4..4 which corresponds when stride reaches the minimum very much, supervising the curve for every M.. The thin film which has 1/4 wave of thickness in S is formed. All vacuum evaporationo sample S .. They are all vacuum evaporationo sample S by repeating driving the shutter 20 with which the sources 2a and 2b of vacuum evaporationo are equipped, and shifting to the following vacuum evaporationo work, after forming such a layer in S.. A highly precise multilayer is formed in S.

[0019] The point which should be observed in the above example is a point of using semiconductor laser 7 as light source for probes. By this, the occurrence section of probe light can be made very compact, and the adoption of the method built in the vacuum chamber 1 of it is attained. Moreover, since semiconductor laser can be driven with a battery, A power circuit 8 is built in in the vacuum chamber 1, and there is an advantage that there is no troublesomeness of introducing a current from the exterior.

[0020] In addition, the pedestal 4..4 in which this invention contains each sample electrode holder 3 is applicable also to the thing which rotates the dome which supports others and these, and the thing of the method which rotates in addition to this revolution although fixed. Moreover, of course in the above example, the thickness monitor of a crystal vibrator sensor method can be used together.

[0021]

[Effect of the Invention] As explained above, according to this invention, for two or more samples electrode holder of every arranged in a vacuum chamber Insertion of the substrate for monitors, While the optical system which leads the reflected light from the laser light source which irradiates a laser beam to the substrate for monitors, and the substrate for monitors obtained by irradiation of the laser beam to the photo sensor prepared out of the concerned chamber through the aperture formed in the vacuum chamber is formed Since the shutter for stopping the vacuum evaporationo to the sample on a sample electrode holder is formed Even when setting and carrying out the vacuum evaporationo of many vacuum evaporationo samples into a vacuum chamber, it is enabled to carry out the monitor of the thickness for every vacuum evaporationo samples of all individually, and an exact optical thickness control becomes possible to many samples. Moreover, since many samples can be processed simultaneously, a cost cut of membrane formation can also be aimed at.

[0022] Furthermore, if the wavelength of a laser light source changes irradiation light wave length by the sweep or selection of each laser light source, the vacuum evaporationo of various thicknesss can also be simultaneously advanced to each sample.

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] In the vacuum evaporation system equipped with two or more sample electrode holders in the vacuum chamber The substrate insertion section for monitors for equipping with the substrate for monitors in the vacuum chamber near [each] the electrode holder for every above-mentioned sample electrode holder, The laser light source which is arranged in a vacuum chamber and irradiates a laser beam at the above-mentioned substrate for monitors, The optical system which leads the reflected light from the substrate for monitors obtained by irradiation of the laser beam to the photo sensor prepared out of the concerned chamber through the aperture formed in the vacuum chamber, The vacuum evaporation system characterized by preparing the shutter for stopping the vacuum evaporationo to the sample on a sample electrode holder, and **.

[Translation done.]

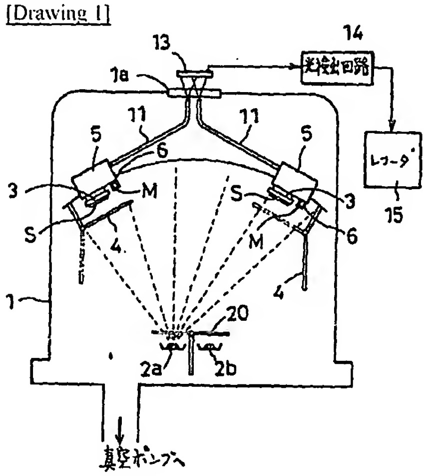
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The cross section showing the configuration of this invention example
[Drawing 2] The enlarged view showing the detailed configuration near each of that sample electrode holder 3
[Drawing 3] The graph which shows the relation between the reflection factor when irradiating the light vacuum evaporationo has predetermined wavelength to a certain layer, membranes being formed, and a thickness
[Drawing 4] The cross section showing the example of a configuration of the conventional vacuum evaporation system which adopted the optical monitor method
[Description of Notations]
1 Vacuum Chamber
1a Aperture
2a, 2b Source of vacuum evaporationo
20 Shutter
3 Sample Electrode Holder
4 Shutter
5 Pedestal
6 Substrate Electrode Holder for Monitors
7 Laser Light Source
8 Power Circuit
9 Collimator Section
10 Beam Splitter
11 Optical Fiber
12 Optical Fiber Bond Part
13 Photo Sensor
14 Photodetection Circuit
15 Recorder
S Vacuum evaporationo sample
M The substrate for monitors

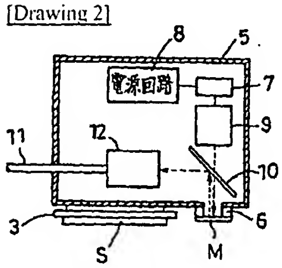
[Translation done.]

DRAWINGS

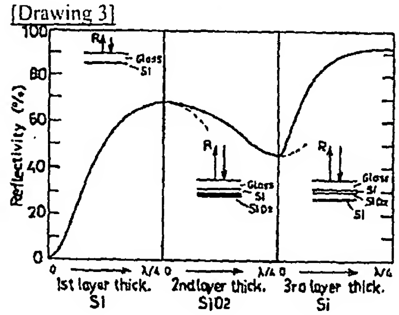
[Drawing 1]



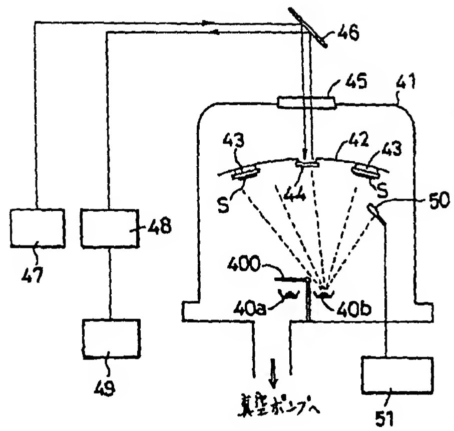
[Drawing 2]



[Drawing 3]



[Drawing 4]



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